

In view of the foregoing amendments and following remarks, the Applicant submits that the Application is now in condition for allowance and respectfully requests a Notice of Allowance issue for claims 1 and 4-19.

1. The Present Invention Reflects the Identification of a Problem and Its Patentable Solution That Was Not Obvious In View of the Cited § 103(a) References.

a. The Amended Claims Are Directed to Use of An Adhesive With Specific After-Cure Properties, Not to Exact Ratios of Adhesive Components.

As part of the § 103(a) rejection of claims 8-11, 13-15 and 18-19, the Examiner states that the hardness and modulus of elasticity properties of the claimed adhesive “would be inherent upon combining” various adhesives. The Examiner further states in response to the Applicant’s August 24, 2000 arguments, that “[s]ince the instant claims do not recite the exact composition of the adhesive . . . the disclosure of Salfelder is still considered to render the claim obvious [because] the hardness and modulus of elasticity are still seen as inherent in the adhesive mixture of Salfelder.” October 20, 2000 Office Action at 3-4.

The Applicant respectfully submits that by focusing on the exact composition of the adhesive mixture, rather than on the desired properties of the adhesive that the Applicant found solved problems of fuel cell leakage, the invention recited in the pending claims has been missed.

As disclosed in the specification, the Applicant determined through extensive experimentation that the problem of poor reliability in the sealing of fuel cells previously known could be addressed by employing an adhesive mixture between the fuel cell frame and the polymer electrolyte film with the following properties: a modulus of elasticity not greater than 10 MPa and/or a durometer A hardness of not greater than 90. *See, e.g.*, Application at 20:21-24-12. In this regard, the Application describes the results of tests of polymer electrolyte film adherence to fuel cell frames wherein a marked increase in the “peeling strength” of the adhesive mixture samples was observed when either the modulus of elasticity of the adhesive was below 10 MPa (preferably below 5 MPa) (Application at 21:9-22; Fig. 8), or the durometer A hardness of the adhesive mixture was not greater than 90 (preferably not greater than 80) (Application at 21:23-22-19; Fig. 9). The Application further discloses the Applicant’s discovery that an adhesive satisfying these elasticity or hardness conditions

enables the adhesive layer to sufficiently expand and contract after cure, so that when a tensile stress is applied to the polymer electrolyte film, the adhesive layer can "follow the stretch" of the film and thereby effectively prevent the film from being broken, while also protecting the adhesive layer itself from damage. Application at 22:24-23:7. Consistent with these disclosures, the Applicant prepared claims which include limitations as to adhesive modulus of elasticity and/or durometer A hardness (the proposed amendments result in every pending claim containing at least one such limitation).

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As to the Examiner's comments concerning the lack of claiming of the exact ratios of the constituents of the adhesive mixtures, the Applicant respectfully submits that the claiming of specific numeric compositions is not necessary here, as the Application already provides sufficient information to enable one of ordinary skill in the art to make or use the invention without undue experimentation (MPEP § 2164.01, test for enablement), and the Applicant has not included limitations in its claims directed to numerical adhesive component proportions. The Applicant has, however, disclosed specific adhesive materials that may be used to obtain an adhesive with the claimed adhesive properties, and further provided guidance in the Application as to the effects of varying ratios of, for example, silicone and epoxy in the adhesive mixture (*see, e.g.*, Application at 21:24-22-2). No further disclosure, such as identification of the exact ratios of adhesive components, is required because one of ordinary skill in the art, having learned of the desired elasticity and harness properties the Applicant determined results in improved fuel cell sealing, could, without undue experimentation, readily create adhesive mixtures with the desired properties from the disclosed materials.

b. The Amended Claims Are Patentable Over the Cited References.

In view of the above, the Applicant respectfully traverses the § 103(a) rejections of the pending amended claims on the grounds that none of the cited references, either alone or in combination, teaches or suggests all the limitations recited in the amended claims, including the identification of the properties of the adhesive mixture necessary and desired to achieve superior bonding and sealing of the polymer electrolyte film to a fuel cell frame.

As to Bloomfield, the cited portion in column 8 only teaches that a polyurethane adhesive can be used to seal a membrane film to a support frame, without providing any discussion or suggestion as to the desired properties of the polyurethane adhesive. Similarly,

the cited portion of column 8 of Salfelder only teaches that certain "[c]onventional adhesives" can be used to adhere layers of insulating materials, without any suggestion of desired adhesive properties, let alone any reference to adhesive modulus of elasticity or durometer A hardness. JP-9-199145 is only cited by the Examiner for its teachings as to making the edges of a membrane hydrophobic, and in any event contains no adhesive property teachings. Finally, Tamura, cited for its teachings are to use of beads to maintain spacing, also does not teach or suggest any aspect of adhesive harness or modulus of elasticity properties.

Because none of the cited references, either alone or in combination, teaches or suggests the amended claims' approach to solving the problem of leaking fuel cells using an adhesive "having a modulus of elasticity of not greater than 10 MPa or a durometer A hardness of not greater than 90 after cure," the independent claims containing such limitations (claims 1, 8, 13 and 17-19) are patentable over these references under § 103(a). In addition, by virtue of their dependency from allowable independent claims, dependent claims 4-7, 9-12 and 14-16 are also patentable over the cited references under § 103(a). The Applicant therefore respectfully requests the pending § 103(a) rejections be reconsidered and withdrawn.

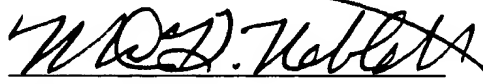
CONCLUSION

In view of the foregoing amendments and remarks, it is respectfully submitted that all entry of the proposed amendments would place the presently pending claims in condition for allowance. The Applicant therefore earnestly solicits entry of the amendments and issuance of a Notice of Allowance for claims 1 and 4-19.

The Examiner is invited to contact the undersigned to discuss any matter concerning this application.

The Office is authorized to charge any underpayment or credit any overpayment to Kenyon & Kenyon Deposit Account No. 11-0600.

Respectfully submitted,



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MARKED-UP VERSION OF AMENDED CLAIM



1. (Once amended) A method of manufacturing a fuel cell by fixing a polymer electrolyte film to a frame, said method comprising the steps of:
causing the polymer electrolyte film to have a water content of not greater than 4,
[which is] expressed as a molar fraction of H₂O; and
bonding the polymer electrolyte film to the frame with an adhesive having a modulus of elasticity of not greater than 10 MPa after cure.

17. (Once amended) A fuel cell, comprising:
a frame; and
a polymer electrolyte film that has a water content of not greater than 4, [which is] expressed as a molar fraction of H₂O, and is bonded to the frame with an adhesive having a modulus of elasticity of not greater than 10 MPa after cure.

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